

CLAIMS

What is claimed is:

1. A method for determining image block significance based on region contrast, the method comprising:

- a) partitioning an image frame into multiple pixel regions of at least one pixel each;
- b) pairing any of said regions with an unpaired, adjoining region;
- c) calculating a similarity value between each region in any of said region pairs;
- d) merging paired regions of any of said pairs into a single region, where said region pair to be merged has a predefined similarity value, thereby creating a new partition of said image frame into multiple pixel regions;
- e) performing steps a) – d) a plurality of times, thereby obtaining a sequence of image partitions;
- f) selecting within said image frame an image sub-area of a predefined size and shape;
- g) identifying a partition in said sequence of partitions in which said image sub-area is covered by any of said regions to the extent of a predefined coverage measure; and
- h) calculating a region contrast significance value $C(B)$ of said image sub-area as a value which is proportional to the position of said identified partition in said sequence of partitions.

2. A method according to claim 1 wherein said calculating step c) comprises calculating the contrast between any of said pairs.

3. A method according to claim 1 wherein said calculating step c) comprises:
calculating the average luminescence of the pixels in one region in any of said pairs; and
subtracting said average luminescence from the average luminescence of the pixels in the other region in said pair.

4. A method according to claim 1 wherein said merging step d) comprises merging where said region pair to be merged has a predefined similarity value representing the least absolute contrast of any of said pairs.
5. A method according to claim 1 wherein said performing step e) comprises performing until a predefined number of regions is achieved.
6. A method according to claim 1 wherein said performing step e) comprises performing until said similarity value reaches a predefined threshold value.
7. A method according to claim 1 wherein said performing step e) comprises performing until a predefined stop condition is met.
8. A method according to claim 1 wherein said selecting step f) comprises selecting an 8x8 pixel block.
9. A method according to claim 1 wherein said identifying step g) comprises identifying the first partition in said sequence of partitions in which said image sub-area is covered by any of said regions to the extent of said predefined coverage measure.
10. A method according to claim 1 wherein said identifying step g) comprises identifying said partition in said sequence of partitions in which said image sub-area is completely covered by any of said regions.
11. A method according to claim 1 wherein said identifying step g) comprises identifying the first partition in said sequence of partitions in which said image sub-area is completely covered by any of said regions.
12. A method according to claim 1 where any of said steps are performed on either of a JPEG image and an MPEG video frame.

13. A method for encoding image sub-areas, the method comprising:
- a) partitioning an image frame into multiple pixel regions of at least one pixel each;
 - b) pairing any of said regions with an unpaired, adjoining region;
 - c) calculating a similarity value between each region in any of said region pairs;
 - d) merging paired regions of any of said pairs into a single region, where said region pair to be merged has a predefined similarity value, thereby creating a new partition of said image frame into multiple pixel regions;
 - e) performing steps a) – d) a plurality of times, thereby obtaining a sequence of image partitions;
 - f) selecting within said image frame an image sub-area of a predefined size and shape;
 - g) identifying a partition in said sequence of partitions in which said image sub-area is covered by any of said regions to the extent of a predefined coverage measure;
 - h) calculating a region contrast significance value of said image sub-area as a value which is proportional to the position of said identified partition in said sequence of partitions; and
 - i) designating said image sub-area for enhanced encoding by a video encoder where said significance value meets a predefined criterion.
14. A method according to claim 13 where any of said steps are performed on either of a JPEG image and an MPEG video frame.
15. A method according to claim 13 wherein said designating step comprises designating where said significance value is at or above a predetermined threshold.
16. A method according to claim 13 wherein said designating step comprises quantizing DCT coefficients of said image sub-area using lower quantizer values than for another image sub-area whose significance value is below said predetermined threshold.

17. A method according to claim 13 wherein said designating step comprises:
scanning DCT coefficients of said image sub-area in accordance with a predefined scanning pattern; and

halting said scanning when $L(B)$ of said DCT coefficients have been scanned,
where

$$L(B) = \begin{cases} 64 & \text{if } C(B) \geq T \\ k \times C(B) & \text{otherwise.} \end{cases}$$

where T is a predefined significance threshold and k is a predefined scaling factor.

18. A method according to claim 13 wherein said designating step comprises:
scanning DCT coefficients of said image sub-area in accordance with a predefined scanning pattern; and

quantizing any of said DCT coefficients located at an i -th position of said scanning pattern using a quantizer value as $P(i) * (M - k * C(B))$,

where $P(i)$ is a value of a quantization pattern for i -th position of said scanning pattern, where M is a quantization threshold, and where k is a predefined scaling factor.

19. A method according to claim 13 wherein said designating step comprises:
determining that said image sub-area is to be encoded in INTRA encoding mode where said significance value meets said predefined criterion.

20. A method according to claim 13 wherein said designating step comprises:
determining that said image sub-area is to be encoded in INTRA encoding mode if said image sub-area has a significance value at or above a predetermined threshold.

21. A method according to claim 13 wherein said designating step comprises:
determining that said image sub-area is to be encoded as the difference between said sub-area and a sub-area in another frame if said first sub-area has a significance value below said threshold.

22. A method for encoding image sub-areas, the method comprising:
segmenting an image into a plurality of regions; and
encoding an image sub-area of an INTER-frame as an INTRA block where
said image sub-area contains pixels from at least two of said regions.

23. Apparatus for encoding image sub-areas according to their significance
comprising:

a video encoder; and

a computation module operative to:

a) partition an image frame into multiple pixel regions of at least one
pixel each;

b) pair any of said regions with an unpaired, adjoining region;

c) calculate a similarity value between each region in any of said
region pairs;

d) merge paired regions of any of said pairs into a single region,
where said region pair to be merged has a predefined similarity value, thereby creating a
new partition of said image frame into multiple pixel regions;

e) perform steps a) – d) a plurality of times, thereby obtaining a
sequence of image partitions;

f) select within said image frame an image sub-area of a predefined
size and shape;

g) identify a partition in said sequence of partitions in which said
image sub-area is covered by any of said regions to the extent of a predefined coverage
measure;

h) calculate a region contrast significance value of said image sub-
area as a value which is proportional to the position of said identified partition in said
sequence of partitions; and

i) designate said image sub-area for enhanced encoding by said
video encoder where said significance value meets a predefined criterion.

24. Apparatus according to claim 23 wherein said computation module is operative to process either of a JPEG image and an MPEG video frame.

25. Apparatus according to claim 23 wherein said computation module is operative to designate said image sub-area for enhanced encoding where said significance value is at or above a predetermined threshold.

26. Apparatus according to claim 23 wherein said computation module is operative to quantize DCT coefficients of said image sub-area using lower quantizer values than for another image sub-area whose significance value is below said predetermined threshold.

27. Apparatus according to claim 23 wherein said computation module is operative to:

scan DCT coefficients of said image sub-area in accordance with a predefined scanning pattern; and

halt said scanning when $L(B)$ of said DCT coefficients have been scanned, where

$$L(B) = \begin{cases} 64 & \text{if } C(B) \geq T \\ k \times C(B) & \text{otherwise.} \end{cases}$$

where T is a predefined significance threshold and k is a predefined scaling factor.

28. Apparatus according to claim 23 wherein said computation module is operative to:

scan DCT coefficients of said image sub-area in accordance with a predefined scanning pattern; and

quantize any of said DCT coefficients located at an i -th position of said scanning pattern using a quantizer value as $P(i) * (M - k * C(B))$,

where $P(i)$ is a value of a quantization pattern for i -th position of said scanning pattern, where M is a quantization threshold, and where k is a predefined scaling factor.

29. Apparatus according to claim 23 wherein said computation module is operative to:

determine that said image sub-area is to be encoded in INTRA encoding mode where said significance value meets said predefined criterion.

30. Apparatus according to claim 23 wherein said computation module is operative to:

determine that said image sub-area is to be encoded in INTRA encoding mode if said image sub-area has a significance value at or above a predetermined threshold.

31. Apparatus according to claim 23 wherein said computation module is operative to:

determine that said image sub-area is to be encoded as the difference between said sub-area and a sub-area in another frame if said first sub-area has a significance value below said threshold.

32. A computer program embodied on a computer-readable medium, the computer program comprising:

a first code segment operative to partition an image frame into multiple pixel regions of at least one pixel each;

a second code segment operative to pair any of said regions with an unpaired, adjoining region;

a third code segment operative to calculate a similarity value between each region in any of said region pairs;

a fourth code segment operative to merge paired regions of any of said pairs into a single region, where said region pair to be merged has a predefined similarity value, thereby creating a new partition of said image frame into multiple pixel regions;

a fifth code segment operative to perform steps a) – d) a plurality of times, thereby obtaining a sequence of image partitions;

a sixth code segment operative to select within said image frame an image sub-area of a predefined size and shape;

a seventh code segment operative to identify a partition in said sequence of partitions in which said image sub-area is covered by any of said regions to the extent of a predefined coverage measure; and

a eighth code segment operative to calculate a region contrast significance value of said image sub-area as a value which is proportional to the position of said identified partition in said sequence of partitions.

32. A computer program according to claim 31 and further comprising:

a ninth code segment operative to designate said image sub-area for enhanced encoding by said video encoder where said significance value meets a predefined criterion.